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ABSTRACT

Two studies compared the effectiveness of the bilingual-dichotic method with conventional diotic methods for teaching Russian vocabulary to English-speakers. Subjects were 101 college students. In the bilingual-dichotic method, the foreign word is presented to the right ear and simultaneously, the equivalent native word is presented to the left ear; then the foreign word is presented to both ears. The learner views the list of new words during the dichotic presentation. In the diotic methods, either the foreign word is presented twice to both ears or the native word is followed by the foreign word. The studies assessed the effectiveness of the bilingual-dichotic method using visual cued-recall for the learning of Russian phrases. The new method was compared with a conventional method, and yielded statistically significantly superior learning performances, averaging 10-18% more correct responses. The effects are sufficient to support application of the method to vocabulary instruction in the early stages of foreign language learning. (MSE)

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Bilingual-Dichotic Learning of Foreign-Language Vocabulary: Visual Cued-Recall and Phrases.[1]

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Running Head: Bilingual-Dichotic Learning

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Abstract

The bilingual-dichotic method compared with conventional diotic methods has yielded improved learning of spoken Russian words by English-speaking students. In the new method, the foreign word is presented to the right ear and simultaneously the equivalent native word to the left ear; then, the foreign word to both ears. The learner views the list of words in parallel to the dichotic format, i.e.,native word - foreign word. In the diotic methods, either the foreign word is presented twice to both ears or the native word followed by the foreign word. The original studies used auditory cued-recall to test for the learning of single words.

The current studies assessed the effectiveness of the bilingual-dichotic method using visual cued-recall to test for the learning of Russian words and auditory cued-recall for the learning of Russian phrases. The new method compared with a conventional method yielded statistically significant superior learning performances that averaged 10 - 18% more correct responses. These effects are sufficient for applications of the method to the acquisition of vocabulary during the early stages of foreign language-learning.

Bilingual-Dichotic Learning of Foreign-Language Vocabulary: Visual Cued-Recall and Phrases.

Neuropsychological evidence suggests that language processing varies with asymmetric functions of the cerebral hemispheres in the development of bilingualism (Genesee, 1982; cf. Zatorre, 1989). This, other findings, and theory on the independence of resources in the cerebral hemispheres provided the rationale for the design of the bilingual-dichotic method (Aarons, 1990).

The bilingual-dichotic method organizes auditory and visual presentations of foreign and native words in paired-associate learning for compatibility with study behavior and the right-ear advantage for verbal material. First, dichotic presentation delivers the foreign word to the right ear simultaneous with the equivalent native word to the left ear; then, diotic presentation delivers the foreign word to both ears. During study, the learner listens to a list of words, attends auditorily to the foreign words, and views the word pairs in a presentation that corresponds to the dichotic format, i.e. native word - foreign word. During testing, the learner says the foreign word upon hearing the native word.

Differences in the hemispheric lateralization of linguistic resources was inferred to support superior learning for the new method in comparison with diotic or dichotic formats that controlled for the left - right positions of foreign and native words in the visual and auditory presentations. Speech behaviors observed during study suggested the need for further research on the auditory stimuli (Aarons, 1990). The present study decreased auditory stimuli by using visual instead of auditory recall-cues and increased them by using phrases instead of words as the learning materials.

Conventional self-instructional methods commonly use diotic presentations of the foreign words in the presence of visual displays of the native and foreign words. The visual representations may be recoded into auditory memory. If the visual and auditory presentations are encoded in different parts of auditory memory during study, then recall may vary with the modality of the test cue at retrieval. Both the bilingual-dichotic and diotic methods allow the learner to share and switch attention across modalities. However, the former has the native word in the auditory modality during study and the latter does not. Consequently, differences in learning performance may be a function of differences in auditory encodings that depend on auditory cued-recall. The first study here used visual instead of auditory cued-recall. It was hypothesized that learning performance would be superior for the bilingual-dichotic compared with the diotic control method. Affirmation of this hypothesis would strengthen one's confidence in the use of the bilingual-dichotic method for facilitating the learning of foreign words.

Processing strategies commonly use linguistically defined phrase-structure units (Gleitman & Gleitman, 1970) to identify words in fluent speech. The utility of the bilingual-dichotic method for foreign language learning would be increased if it improved the memorization of phrases. Indeed, the greater complexity of temporal patterning in phrases provides a strong stimulus

for the right-ear advantage in dichotic listening (Zurif & Mendelsohn, 1972). An increased right-ear advantage enhances perceptual accuracy (Block & Hellige, 1989) that may aid the storage of larger verbal units. The second study here used foreign-language phrases as the learning material. It was hypothesized that the bilingual-dichotic method would yield a superior learning performance in comparison with the diotic control method. Affirmation of this hypothesis would extend the utility of the bilingual-dichotic method from words to phrases for learning of the foreign-language lexicon.

METHOD

Subjects

One hundred and one students with a median age of 19.5 years volunteered to be in these studies as an alternate requirement for credit toward their grade in an introductory psychology course. Each student was a self-reported right-handed writer with normal or corrected vision, no current or previous hearing problem, no experience with dichotic listening, and no knowledge of Russian or any other Slavic language. The students had a median of 2 years of other foreign-language education and were fully competent in American English. Fifty-four students provided the data in study 1 and 47 in study 2.

Materials

The words in study 1 were identical to those of the original study (Aarons, 1990). In brief, each word was presented twice

in the bilingual-dichotic (ER) or diotic (RR) formats through Sennheiser HD400 open-air stereophonic headphones. The former presented simultaneously the Russian word or phrase to the right ear and the English word or phrase to the left ear and then the Russian word or phrase to both ears. The latter delivered the Russian word or phrase to both ears in each presentation. In study 1, all words were in the author's voice; in study 2, the Russian phrases were in male and female voices, and the English in the author's voice.

In the bilingual-dichotic condition, the visual format was English - Russian (E-R), e.g., nation - NAROD. In the diotic condition, the visual format was Russian - English (R-E), e.g., NAROD - nation, because performance was better with this format than the reverse one in the same diotic condition of the original study (Aarons, 1990). Likewise, corresponding visual formats were used for the phrases in study 2. The arrangements of the phrases are shown in Figure 1.

Insert Figure 1 about here

The preparation and measured specifications of tape recordings for the words and phrases were as described in the original study (Aarons, 1990). The words or phrases were typed in vertical lists on separate 7.7 x 12.8 cm unlined white index cards. The English words or phrases appeared in lower case letters next to their

Russian equivalents. Because students naive to Russian were used to preclude confounding of results by prior knowledge, capitalized Latin letters replaced the Cyrillic alphabet in transliterations of the Russian words or phrases. In study 1, one five-word practice list and two ten-word study lists appeared in three different random orders. In study 2, one practice list of three two-word and one three-word phrases and two study lists of five two-word and two three-word phrases appeared in three different random orders.

Procedure

The general features of the procedure were identical to those of the original study (Aarons, 1990). Each student was interviewed, given auditory digit-span tests (Wechsler, 1944), and tested individually in a quiet room. A quasi-random assignment of the students to the task conditions provided an overall balance by sex, foreign-language education, and forward digit-span performance in their distribution between conditions. Each condition in study 1 had 27 students; in study 2, the experimental condition had 24, the control, 23 students.

The task was explained as the learning of spoken Russian words or phrases through English equivalents by listening to them while viewing them on a hand-held index card. The assigned condition was described to the learner but without instruction as to the use of any specific listening or study strategy. However, for those in the bilingual-dichotic condition, the presence of both the

visual and auditory presentations of the English words or phrases for use in learning was mentioned.

The student was told that accurate pronunciation of the Russian word or phrase within 5 seconds of the English test word or phrase was required for a correct response. The student was then given an opportunity to ask any question about the study and clarifications in general terms were given as needed. Finally, the student was told that he or she would continue studying until either criterion performance defined as 100% correct responses on one presentation of the list or an unspecified but fixed number of study-test trials had occurred.

Sessions lasted from about 40 minutes to 1 hour and 15 minutes. First, the word- or phrase-list card was handed to the student and the Sony TC366 tape deck started. At the end of the list, the tape was stopped and the card retrieved from the student. Then, in study 1, each English word was presented at a distance of about 64 cm in 2cm high black-inked lettering at the center of 12.8 x 7.7 cm white index card in the same order as that of the study list for the cued-recall of the Russian word. A stop watch was started with the exposure of the word and stopped at the start of the student's response or when 5 seconds had elapsed. The practice list was studied until one errorless trial or 12 trials had occurred.

Study 2 used pronunciation trials in which the student

heard and read aloud each Russian phrase prior to the study trials. If a phrase was not pronounced correctly, the student was corrected and another complete pronunciation trial was given.

After practice, the study lists 1 and 2 were given in counterbalanced order between one half of the students within each condition. The procedure for the study lists was identical to that of the practice list. A five-minute rest interval separated the study periods of the two lists. Students in the bilingual-dichotic conditions were asked at the end of the session about their affective reactions to the dichotic stimulation *per se*.

Measures and data analyses

Correct responses and latencies of correct responses were averaged for each student, word list, trial, and condition. Differences in learning effects between conditions were compared for (a) criterion performances, and (b) overall or total group performances. Measures for (a) include the percentage of students who achieved criterion performance and their average number of trials to reach criterion. Measures for (b) include the average correct response and latency scores for the entire group, i.e., the combined criterion and noncriterion performances.

RESULTS

Study 1: Visual cued-recall

Criterion and total group performances for learning are given in Table 1. The frequency of criterion performance for the bi-

lingual-dichotic compared with the diotic condition were 26% greater on list 1, $\chi^2(1,N=54) = 6.48$, $p < .01$, and 15% greater on list 2, $\chi^2(1,N=54) = 2.53$, $p > .05$. Despite the lack of statistical significance on list 2, these gains are consistent with those obtained for auditory cued-recall, i.e., respectively, 27% and 22% (Aarons, 1990). More trials were needed with the diotic than with the bilingual-dichotic condition to reach criterion. However, differences were not statistically significant, 15% on list 1, $z = .71$, $p = .24$, and 19% on list 2, $z = 1.08$, $p = .14$.

Insert Table 1 about here

The total group performance measures are not limited by an arbitrary criterion of learning. The bilingual-dichotic condition yielded reliably higher levels of correct responses compared with the diotic condition. The former exceeded the latter by 12% on list 1, $t(52) = 1.98$, $p = .02$, and 8% on list 2, $t(52) = 1.67$, $p = .05$. These differences are smaller than but consistent with those obtained for auditory cued-recall, i.e., respectively, 15% and 19% (Aarons, 1990). Latencies of correct responses were not different between conditions on list 1, $t(52) = .66$, $p = .25$, and list 2, $t(52) = .05$, $p = .48$, although the bilingual-dichotic had significantly shorter latencies with auditory cued-recall (Aarons, 1990).

A three-way analyses of variance examined effects on the

correct responses for the learning conditions, modality of the recall-cue, and forward digit-span factors in the combined data of this and the original study (Aarons, 1990). Forward digit-span was used to group the data as: low or 5 and 6, medium 7, and high 8 and 9. The bilingual-dichotic yielded 13% more correct responses than the diotic condition had on list 1, $\underline{F}(1,97) = 10.458$, $\underline{p} = .002$, $MS_e = 14.981$, and 10% more on list 2, $\underline{F}(1,97) = 9.785$, $\underline{p} = .002$, $MS_e = 10.282$. Auditory cued-recall did not differ from visual cued-recall on list 1, but yielded 8% more correct responses on list 2, $\underline{F}(1,97) = 5.458$, $\underline{p} = .02$, $MS_e = 5.735$. Correct responses for the digit-span factor were reliably different only on list 2, $\underline{F}(2,97) = 3.252$, $\underline{p} = .042$, $MS_e = 3.418$. Thus, total performance is better with the bilingual-dichotic than with the diotic method regardless of the modality used in recall testing; with practice, however, auditory cues may be more effective than visual ones for recall.

About 61% of the students reported indifference and 28% to have liked the bilingual-dichotic method. These reactions are less marked but consistent with the corresponding rates of 45% and 35% that were obtained for auditory cued-recall (Aarons, 1990).

Study 2: Learning of phrases

The criterion and total group performances for learning are given in Table 2. In general, learning was better with the bilingual-dichotic than with the diotic condition. More students reach-

ed criterion with the former than with the latter method on both lists. However, these differences and that of trials to criterion were not statistically significant.

The bilingual-dichotic yielded reliably more correct responses for total group performance than that of the diotic condition. The former showed a 24% higher level than the latter on list 1, $z = 1.85$, $p = .03$, and 14% higher on list 2, $z = 1.68$, $p = .05$. The latencies of correct responses were not different between conditions. Equal numbers of students reported positive, negative, and indifferent reactions to the bilingual-dichotic method. The superior overall performance for the bilingual-dichotic compared with the diotic method is shown in Figure 2.

Insert Table 2 & Figure 2 about here

DISCUSSION

The bilingual-dichotic compared with a conventional diotic method improved overall performance for the recall of visual-cued Russian words and auditory-cued Russian phrases. The enhancement of learning through constructive replication of the original study (Lykken, 1968) corroborates the validity of theory on the independence of resources in the cerebral hemispheres for the bilingual-dichotic method (Aarons, 1990).

The effectiveness of the visual and auditory modalities in paired-associate learning has been related to their use in the

operations of storage and retrieval. Most importantly, the use of different modalities compared with the use of the same modality for encoding and recall has resulted in poorer performance (Murdock, 1967). The situation is more complex in this experiment where both modalities are available in study and only one in testing. Oddly, conventional self-instructional programs for learning foreign languages do not consistently use either the auditory or visual modality for testing, or indeed, self-testing per se.

Learners may prefer visual to auditory cues because the former modality is more convenient for self-pacing during study and self-testing. As suggested, the learner's native-language reading ability may influence performance with the bilingual-dichotic method (Aarons, 1990). Clearly, visual cues are inappropriate for illiterate and semiliterate adults who also have difficulty recognizing words in dichotic listening (Morais et al., 1987). Moreover, reading rates on word lists show significant and highly positive correlations with spans for phonemically codable material in short-term memory (Baddeley, Thomson, & Buchanan, 1975). Thus, better readers may more efficiently use the visual modality in encoding and recall with the bilingual-dichotic method. Likewise, differences in reading abilities may be expected to influence use of the bilingual-dichotic method in the learning of phrases.

Short-term memory is not restricted to single words or to a few elements within a word unit and may hold larger, complex se-

quences such as phrases when they are presented as a unit (Glanzer & Razel, 1974). Isolated words tend to be pronounced slowly and are somewhat elongated. In contrast, words in phrases yield more fluent syllabic timing (Huggins, 1972) to assist in the perception of continuous speech. Similarly, reading like speech requires a basic familiarity with phrases as well as with words. Consequently, in addition to the semantic advantages provided by the knowledge of phrases, the learning of phrases should help both the perception and production of foreign-language vocabulary.

The bilingual-dichotic method with visual cued-recall for self-testing and its use with phrases could facilitate learning of the initial lexicon in a foreign language.

Figure Captions

Figure 1. Arrangements of English and Russian phrases for auditory and visual presentations.

Figure 2. Mean correct responses by trials of study for lists 1 and 2 with dichotic ER and diotic RR presentations.

Auditory Formats

Dichotic			Diotic		
Left Ear		Right Ear	Left Ear		Right Ear
English	&	Russian (ER)	Russian	&	Russian (RR)
your chair		VASH SHTOOL	VASH SHTOOL		VASH SHTOOL
VASH SHTOOL		VASH SHTOOL	VASH SHTOOL		VASH SHTOOL
that room		TA KUMNATA	TA KUMNATA		TA KUMNATA
TA KUMNATA		TA KUMNATA	TA KUMNATA		TA KUMNATA
I'm hungry		YA GOLADIN	YA GOLADIN		YA GOLADIN
YA GOLADIN		YA GOLADIN	YA GOLADIN		YA GOLADIN

Visual Formats

English	-	Russian (E-R)	Russian	-	English (R-E)
your chair	-	VASH SHTOOL	VASH SHTOOL	-	your chair
that room	-	TA KUMNATA	TA KUMNATA	-	that room
I'm hungry	-	YA GOLADIN	YA GOLADIN	-	I'm hungry

Figure 1. Arrangements of English and Russian phrases for auditory and visual presentations.

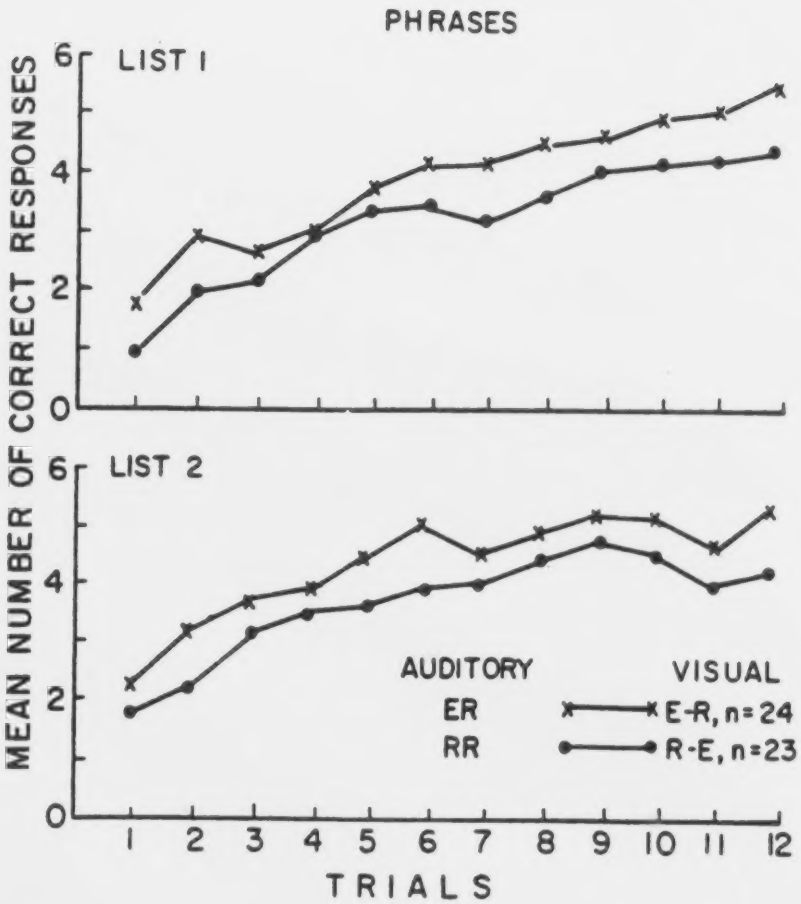

Figure 2. Mean correct responses by trials of study for lists 1 and 2 with dichotic ER and diotic RR presentations.

Table 1

Criterion and Total Performances in Learning Words Tested by Visual Cued-Recall

(Mean, Standard Deviation)

List	Criterion Performance (CP)		Total Performance	
	Percentage CP	Trials	Correct Responses	Latencies (secs)
		Bilingual - Dichotic		
1	89	7.1 (2.0)	6.05 (1.08)	1.49 (.34)
2	89	6.2 (2.4)	6.29 (0.97)	1.49 (.36)
		Diotic		
1	63	8.2 (2.6)	5.41 (1.29)	1.54 (.33)
2	74	7.4 (2.2)	5.80 (1.16)	1.48 (.40)

Table 2

Criterion and Total Performances in the Learning of Phrases

(Mean, Standard Deviation)

List	Criterion Performance (CP)		Total Performance	
	Percentage CP	Trials	Correct Responses	Latencies (secs)
		Bilingual - Dichotic		
1	58	6.9 (3.6)	4.04 (1.01)	1.25 (.25)
2	80	7.3 (2.9)	4.28 (0.76)	1.25 (.24)
		Diotic		
1	43	8.9 (2.7)	3.27 (1.18)	1.29 (.35)
2	61	7.4 (2.5)	3.76 (1.07)	1.40 (.48)

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